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Temporary extracorporeal axillo-iliac vascular prosthesis shunt in open repair of a pararenal aortic aneurysm

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ABSTRACT

INTRODUCTION: When a long aortic clamp time is expected or when upper body to lower body collateral arteries are sparse, temporary lower body perfusion may be needed to reduce ischemic injury during supraceliac clamping in open repair of pararenal aortic aneurysms. The use of conventional extracorporeal perfusion techniques carry extra risks and is not in the armamentarium of most vascular surgeons. An axillo-femoral or -iliac shunt using a vascular prosthesis does not require the same degree of anticoagulation and causes less activation of blood components.

PRESENTATION OF CASE: A patient, who had extensive vascular stenotic disease and large bowel ischemia, was operated on for a pararenal aortic aneurysm while the lower body was perfused via a temporary extracorporeal vascular prosthesis axillo-iliac shunt. Copious backbleeding encountered while suturing the proximal anastomosis testified to the efficacy of the temporary shunt. A left hemicolectomy had to be performed for gangrene of the sigmoid colon and he needed 2 days of respiratory support; otherwise the postoperative course was uneventful.

DISCUSSION: In our case more ischemic injury than that observed might have been expected without the temporary bypass but significant backbleeding may have negated some of the beneficial effect of the shunt.

CONCLUSION: A temporary axillo-femoral or -iliac shunt prevents lower limb ischemia and provides an ample amount of collateral blood flow to the torso. It does not need to be buried subcutaneously as previously described. Occlusive balloons should be used where possible to prevent backbleeding and to further increase available collateral blood supply.

1. Introduction

Although the best treatment of juxta- and supra-renal abdominal aortic aneurysms is controversial,[1,2] good perioperative results with 30 day mortality rates of 0.8%–2.8% and long-term survival similar to that of patients operated on for infrarenal aneurysms have been obtained with open repair using suprarenal or supraceliac aortic clamping without the use of adjuncts.[2–4] In patients with pararenal aortic aneurysms the proximal anastomosis usually can be performed fast enough to allow supraceliac clamping without causing significant visceral ischemic injury. But when a long clamp time is expected or when upper body to lower body collateral arteries are sparse, temporary lower body perfusion may be used to reduce the risk of ischemic injury. The risk of end-organ damage may be less with supraceliac than with infraceliac clamping because of a lower risk of atheroembolism.[5] Whereas temporary lower body perfusion may be performed by partial cardiopulmonary or left heart bypass with the attending risks, an axillo-femoral or -iliac shunt using a vascular prosthesis can be performed by vascular surgeons.[6,7] This approach does not require the same degree of anticoagulation and causes less activation of blood components. Common to all distal perfusion techniques is the challenge of increased backbleeding from lumbar and visceral arteries.

2. Presentation of case

A 65-year-old man who was a smoker was admitted in January 2008 with a 6-cm wide pararenal aortic aneurysm. He was on simvastatin and aspirin, was being treated for hypertension with nifedipine, for diabetes mellitus with metformin and for chronic stable schizophrenia with sodium valproate and risperidone. He suffered from intermittent claudication in both calves after walking 200 m. His activity level during the last years had been very low. A left renal artery stenosis had been treated with angioplasty and stenting 8 years earlier and with angioplasty for restenosis 1 year thereafter. A computed tomography angiography showed two right renal arteries that originated from the aneurysm neck while the left one originated from the aneurysm (Fig. 1). His left superficial femoral artery was occluded. When aneurysm surgery was planned it was decided to perfuse the lower body with a temporary axillo-external iliac bypass to reduce the likelihood of ischemic

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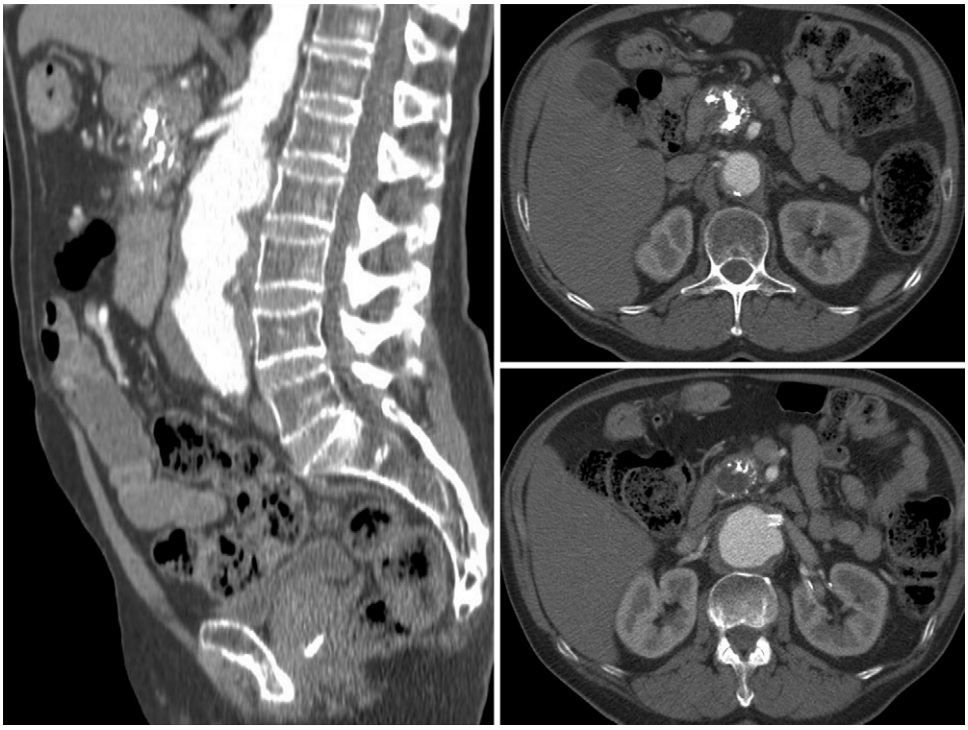

Fig. 1. Computed tomography angiography performed 10 weeks prior to the operation. The left panel shows a sagittal section of the aorta, the upper left panel shows a transverse section at the level of the two right renal arteries, and the lower left panel shows a transverse section at the level of the left renal artery with a stent at its origin.

complications during aortic clamping. A long clamp time was anticipated since care had to be taken while suturing the proximal anastomosis at the lower rim of the right renal arteries, endarterectomy or plasty of the left renal ostium might be necessary prior to the anastomosis and endarterectomy of the iliac ostia would also be necessary.

With the patient supine the right axillary artery was first free-prepared through an infraclavicular delto-pectoral incision. Then the aneurysm was accessed through a midline incision till under the left renal vein. It was noted that the sigmoid colon was excessively long and dilated with gas, and bluish discolored. To reduce tension, a large amount of gas was manually expelled through the anus. A short 6-mm Dacron graft for the left renal artery was sutured as a side branch close to the proximal end of a 22 mm tube graft prior to aortic clamping. A 10-mm Dacron graft was anastomosed to the right axillary and to the right external iliac artery. The aorta was clamped proximally to the celiac artery. The aneurysm was opened, mural thrombus was removed and the common iliac arteries were occluded using balloon catheters. After deairing, the axillo-iliac shunt was started. The stent in the left renal artery protruded 1 mm into the aortic lumen, but was totally grown into the artery wall and there was no stenosis. It was therefore left in place. Cold heparinized Ringer acetate was infused into the ostium using a baby feeding tube. After completion of the proximal anastomosis, the graft was flushed before being clamped and the supraceliac clamp removed. Then the side branch was anastomosed to the aortic wall just outside the stent and the left kidney was reperfused. Following endarterectomy of the distal aorta and common iliac ostia the distal anastomosis was completed and the temporary bypass was removed. The axillary incision was closed. The sigmoid colon had again become excessively dilated with gas and showed small areas of thrombosed mural vessels and there was a smell of intestinal gangrene. A left colectomy was performed a.m. Hartmann.

During implantation of the aortic prosthesis there was copious back bleeding from renal and visceral arterial ostia. Blood was collected and red cells reinfused, using a cell saver. Due to clot formation, the cell saver had to be changed during which 1.7 L of blood was sucked with an ordinary sucker. Altogether 7.3 L, of which 5.3 L during the 40 min while the proximal anastomosis was sutured, was collected using the cell saver. The entire operation lasted 8.5 h. Postoperatively he had ventilatory support for 2 days. Laboratory tests showed signs of ischemic injury without clinical consequences (Table 1). The further course was uneventful apart from development of a parastomal hernia 3 months postoperatively. Seven months postoperatively his colostomy was closed and a colorectal anastomosis was performed. Three years postoperatively he was admitted in another hospital with elevated blood glucose and a pulmonary infiltrate was found. A follow-up examination 4 months later revealed a 5.8×5.1 cm carcinoma-suspect tumor in the liver. The tumor grew to a diameter of 11 cm within 7 months. Three-and-a-half year postoperatively he was observed 5 days in the ward for intestinal obstruction which resolved without intervention. Three years and 11 months postoperatively he died of hepatic carcinoma with pulmonary metastases.

3. Discussion

A few previous reports show the benefit of ischemia prevention by a temporary axillo-femoral bypass using a vascular prosthesis in open repair of aortic diseases.[8–11] In our case supraceliac clamping for 40 min, juxtarenal clamping for some 25 min, and infrarenal clamping for approximately another 25 min, ischemic injury in the left lower extremity where the SFA was occluded might have been anticipated without the temporary bypass. Gangrene development in the preoperatively dilated and cyanotic sigmoid colon was not unexpected, but it is uncertain whether the axillo-iliac shunt prevented even more extensive colon gangrene. The copious backbleeding encountered while suturing the proximal anastomosis testified to the efficacy of the temporary bypass to supply blood to the torso, but caused a significant blood loss that may have negated some of the beneficial effect of the shunt. In retrospect, much of the blood loss might have been avoided, and

Table 1
Perioperative blood chemistry parameters.

Parameter	Postoperative day					
	−1	0	1	2	5	68
Serum-creatinine (μmol/L, 60–105)	44	67	104	124	116	65[a]
Estimated GFR (mL/min/1.73 m^2, not defined)	>60	>60	>60	51	55	>60
Serum-gamma-GT (U/L, 15–115)		7	15		49	
Serum-ALAT (U/L, 10–70)		78	138		146	
Serum-ASAT (U/L, 15–45)				234	66	
Serum-LDH (U/L, 105–205)		231	465		397	
Serum-CK (U/L, 40–280)		209	1152	961		
Serum-troponin T (μg/L, <0.03)		0.06	0.03			
Serum-myoglobin (μg/L, <70)			1404	407		
Blood-hemoglobin (g/dL, 13.4–17)	15.6	12.3	9.3	8.7	8.8	12.8

Parentheses in the first column show unit definitions and normal ranges.
[a] Three-and-a-half years postoperatively serum-creatinine was 45.

collateral visceral blood supply improved correspondingly, by using a suprarenal intra-aortic Foley catheter and vascular occlusion balloon catheters in the right renal ostia to prevent back bleeding.[12] The main lessons from this patient are that a temporary axillo-femoral or -iliac bypass using a vascular prosthesis may prevent lower limb ischemia and provide an ample amount of collateral blood flow to the torso. It does not need to be buried subcutaneously as previously described.[8] Occlusive balloons should be used where possible to prevent backbleeding and to further increase available collateral blood supply.[13]

An advantage with a sutured axillo-femoral or -iliac shunt is that it does not impede blood flow in the ipsilateral lower extremity like a cannula may do. Disadvantages with the perfusion method proposed in this paper are the risk of complications due to the extra vascular access and additional operative time that is needed for the extra anastomoses.

4. Conclusion

A temporary axillo-femoral or -iliac bypass using a vascular prosthesis prevents lower limb ischemia and provides an ample amount of collateral blood flow to the torso. It does not need to be buried subcutaneously as previously described. Occlusive balloons should be used where possible to prevent backbleeding and to further increase available collateral blood supply.

Conflict of interest

The author has no conflict of interests in respect to the article.

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Ethical approval

Written informed consent was obtained from the next-of-kin for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contributions

ED is the only contributor to this article.

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